Aquifer Storage and Recovery (ASR) Evaluation Ahtanum-Moxee Subbasin Groundwater Flow Model

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Introduction

Outline

- *Project Introduction*
- *Yakima Basin Setting*
- *ASR Pilot Test Review*
- *Ahtanum Subbasin ASR Model*
- *Results and Conclusions*

Acknowledgements

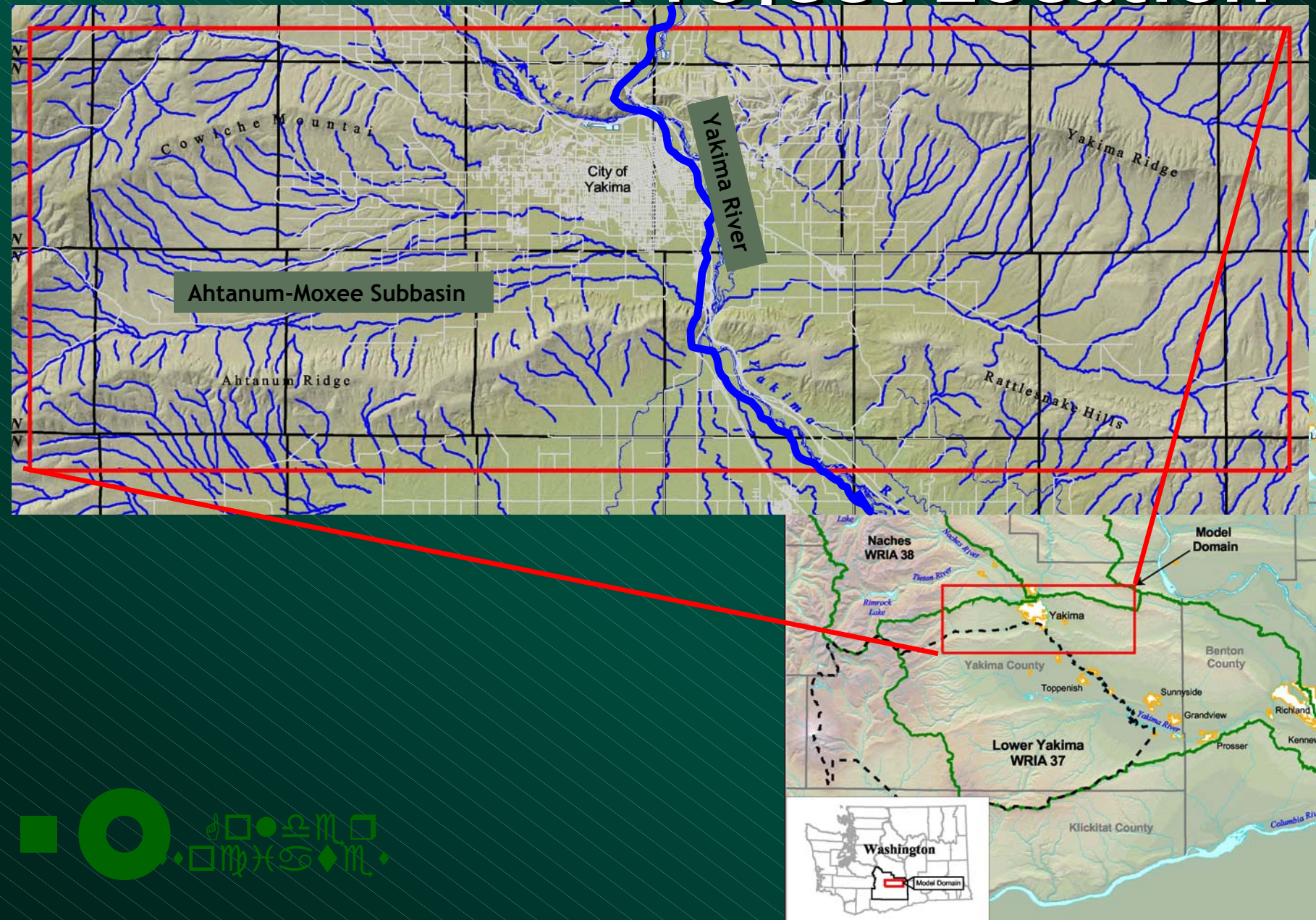
- *City of Yakima*
- *Tri-County Water Resource Agency*
- *Department of Ecology*

Introduction

Project Goals:

- *Develop conceptual hydrogeological model*
- *Develop groundwater flow model to evaluate ASR for a 10-year period*
- *Support permitting of ASR permit*

Project Location



ASR Concept

Aquifer Storage and Recovery

Any storage of water underground that is later recovered for use.

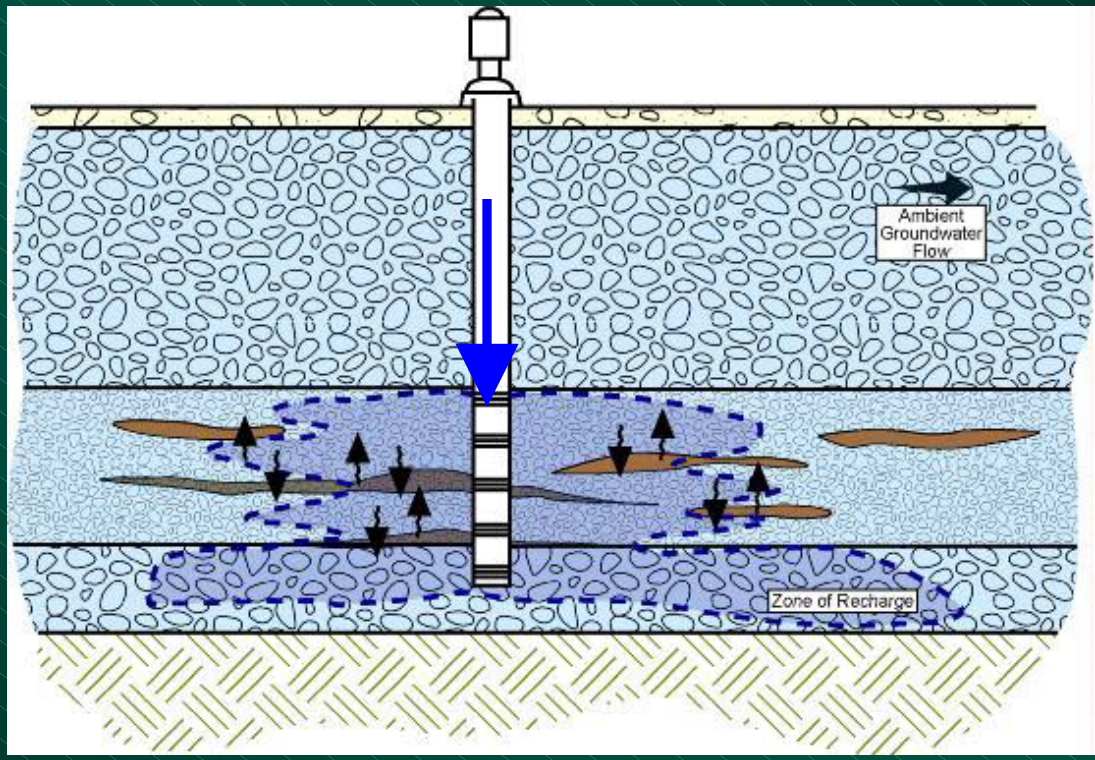
AQUIFER recharge occurs via infiltration basins or recharge wells.

STORAGE occurs in the aquifer.

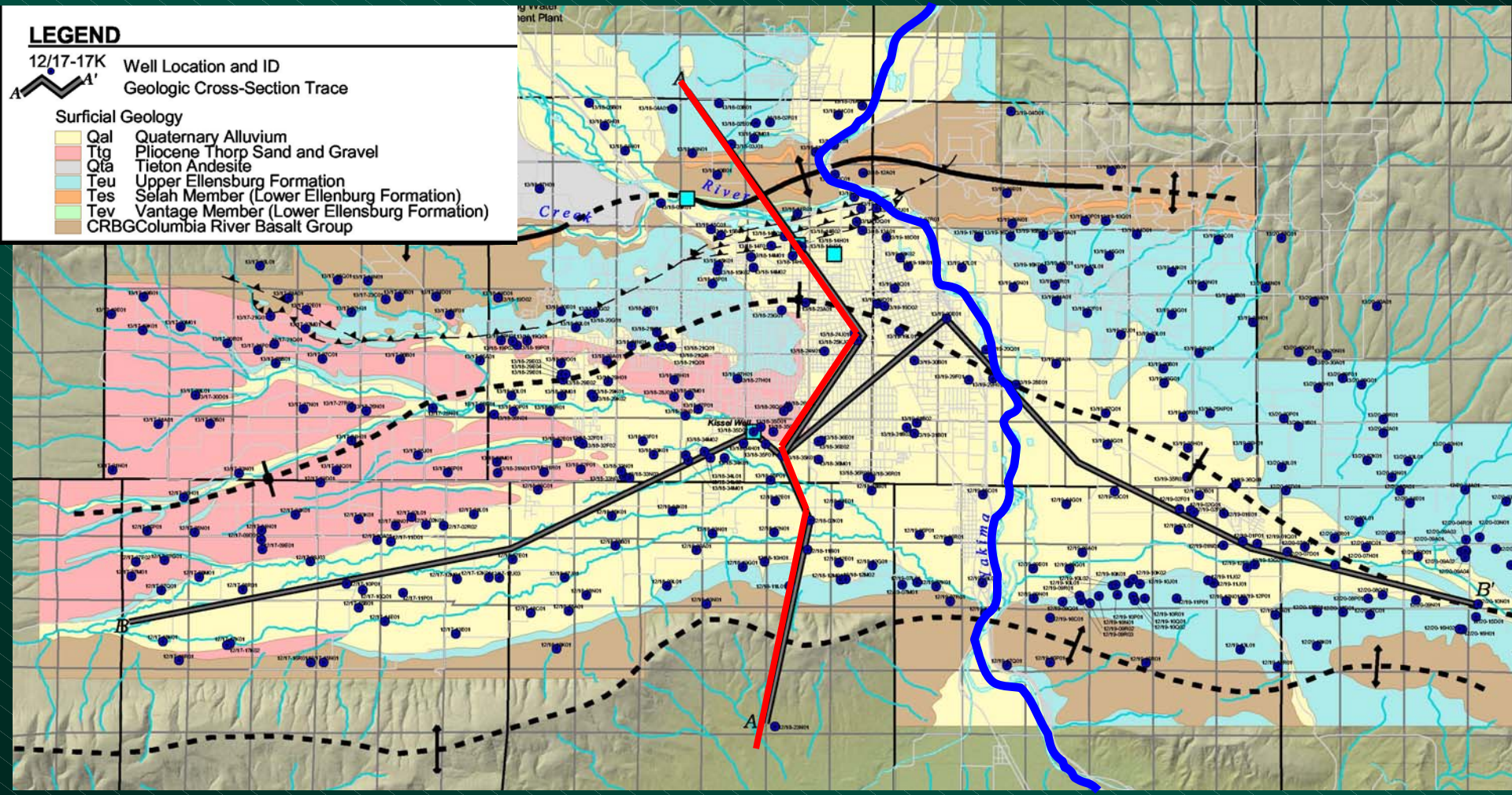
RECOVERY occurs via wells.

Typical Uses:

- Peaking Source
- Secondary Source
- Emergency Source
- Groundwater Management

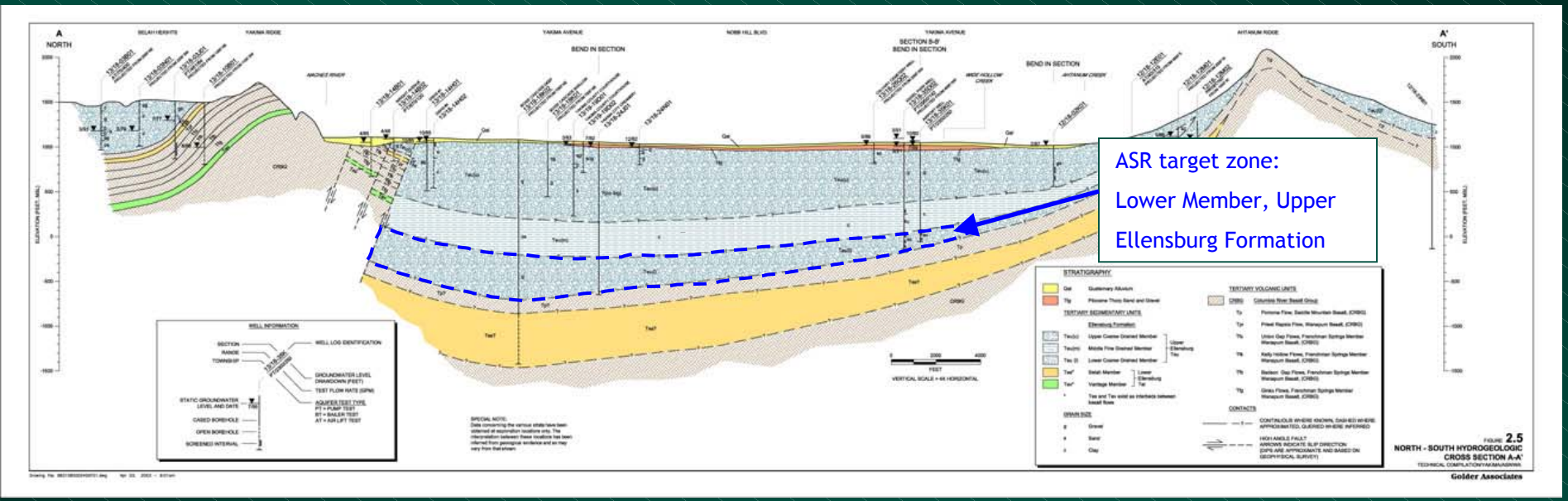


Geology



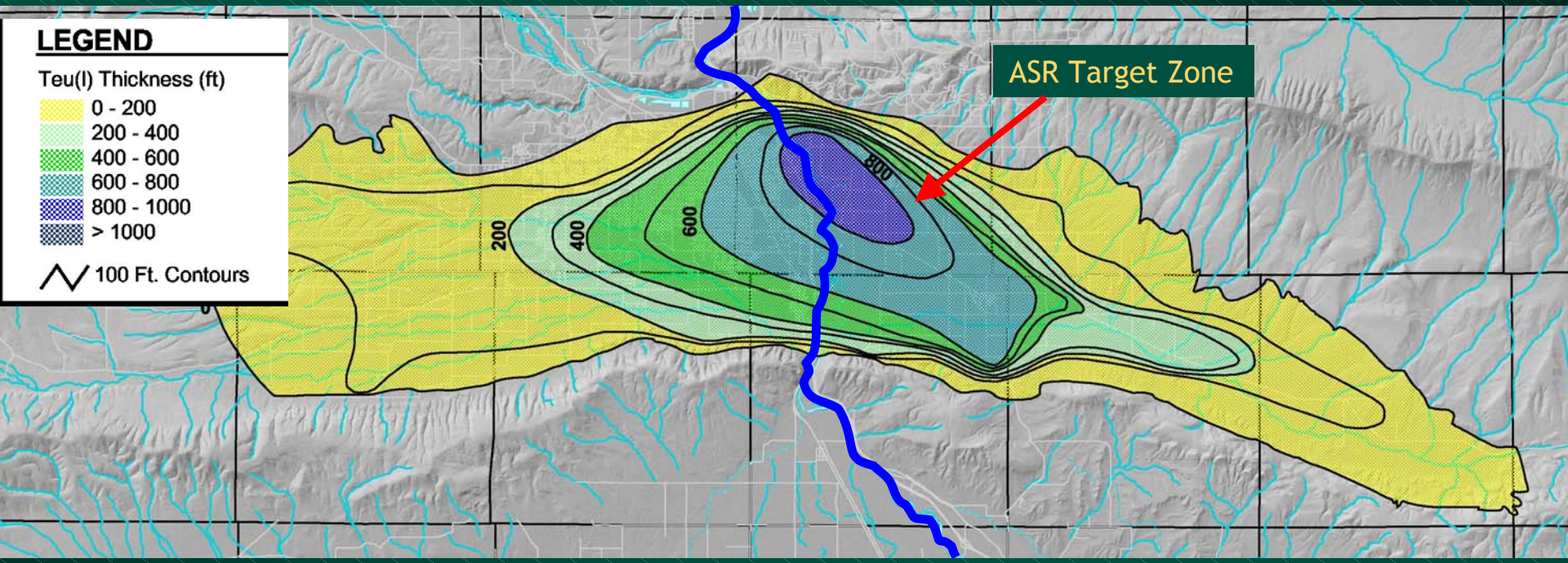
Geologic map and cross section locations. Wells used in model development shown.

Stratigraphy



North-South Geologic Cross Section A-A’

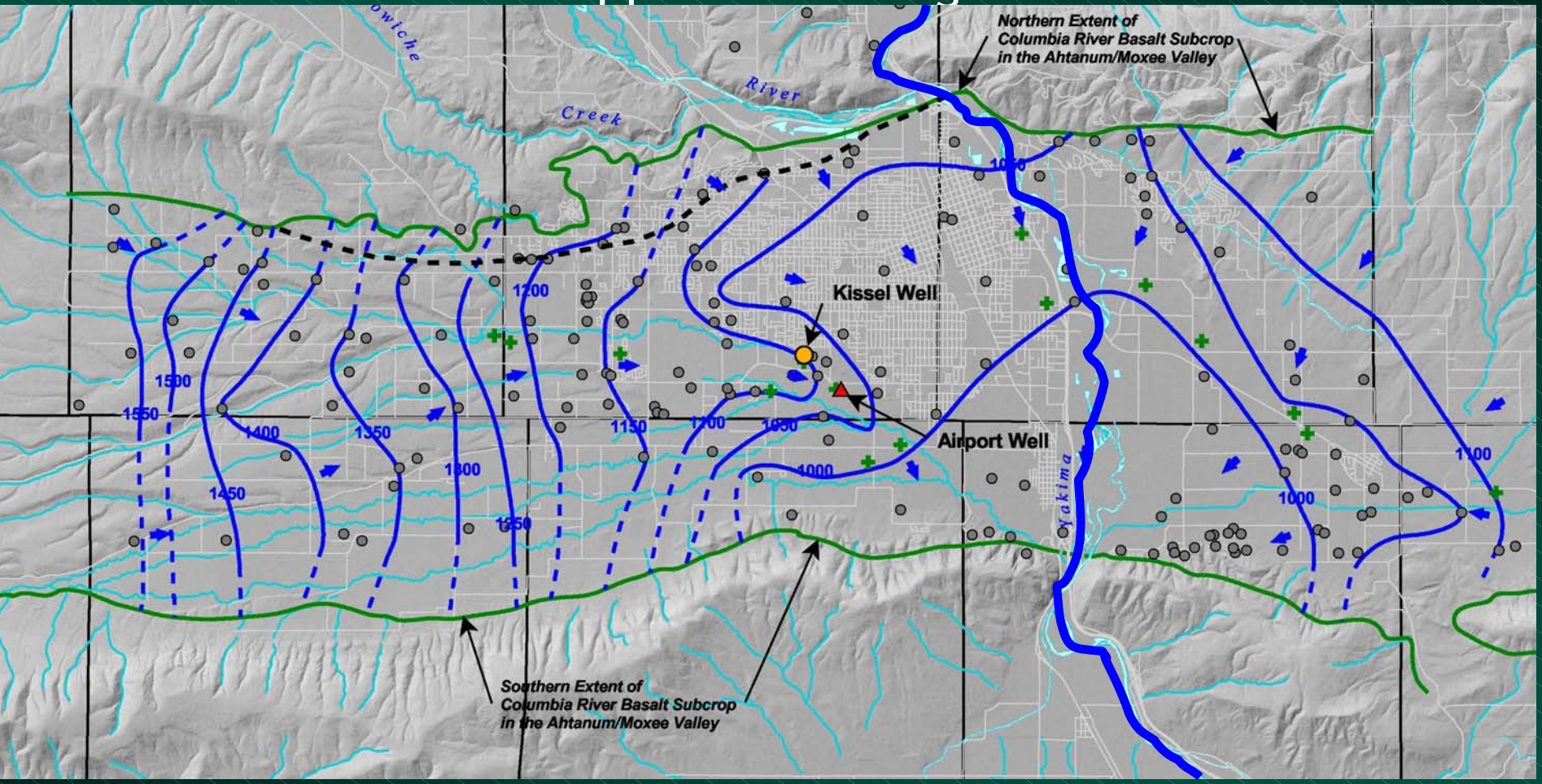
Target Aquifer Thickness



Thickness of Lower Member of Upper Ellensburg Formation - ASR Target Aquifer

Hydrology

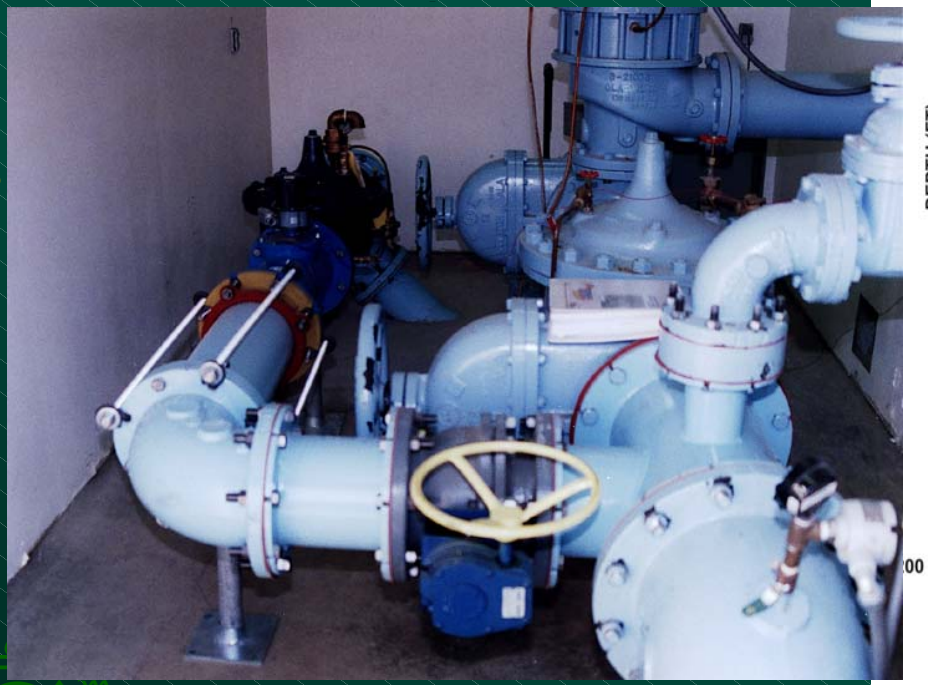
Groundwater Flow in Upper Ellensburg Formation

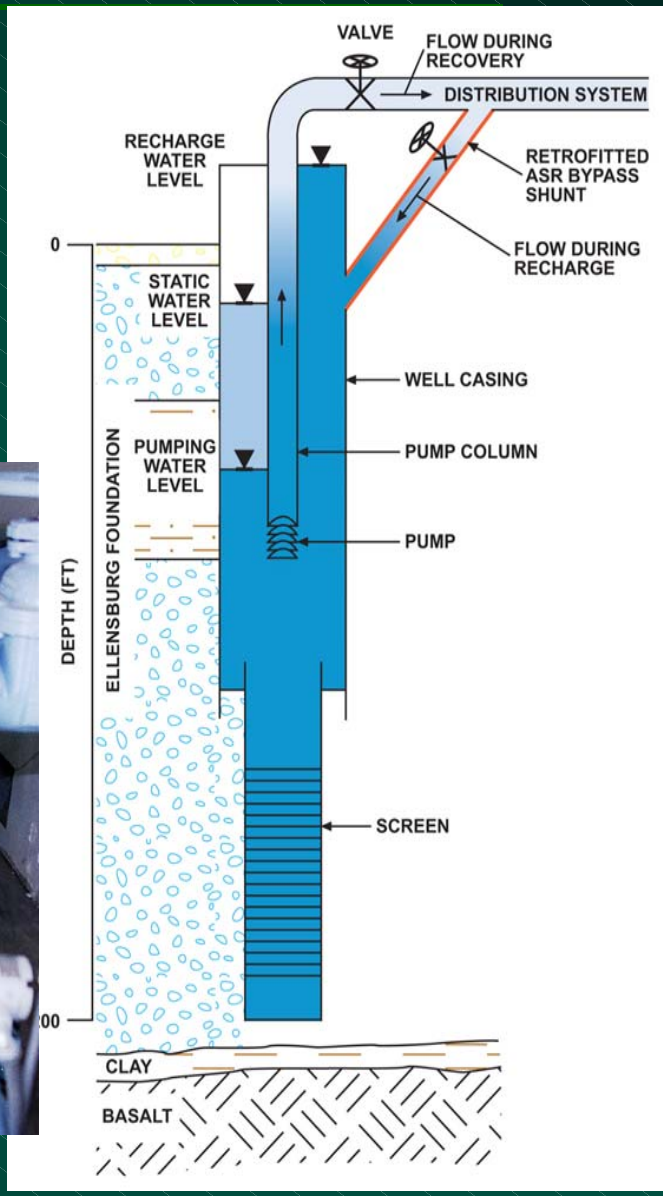


ASR Pilot Testing Review

City Of Yakima ASR Pilot Test 2000-2001

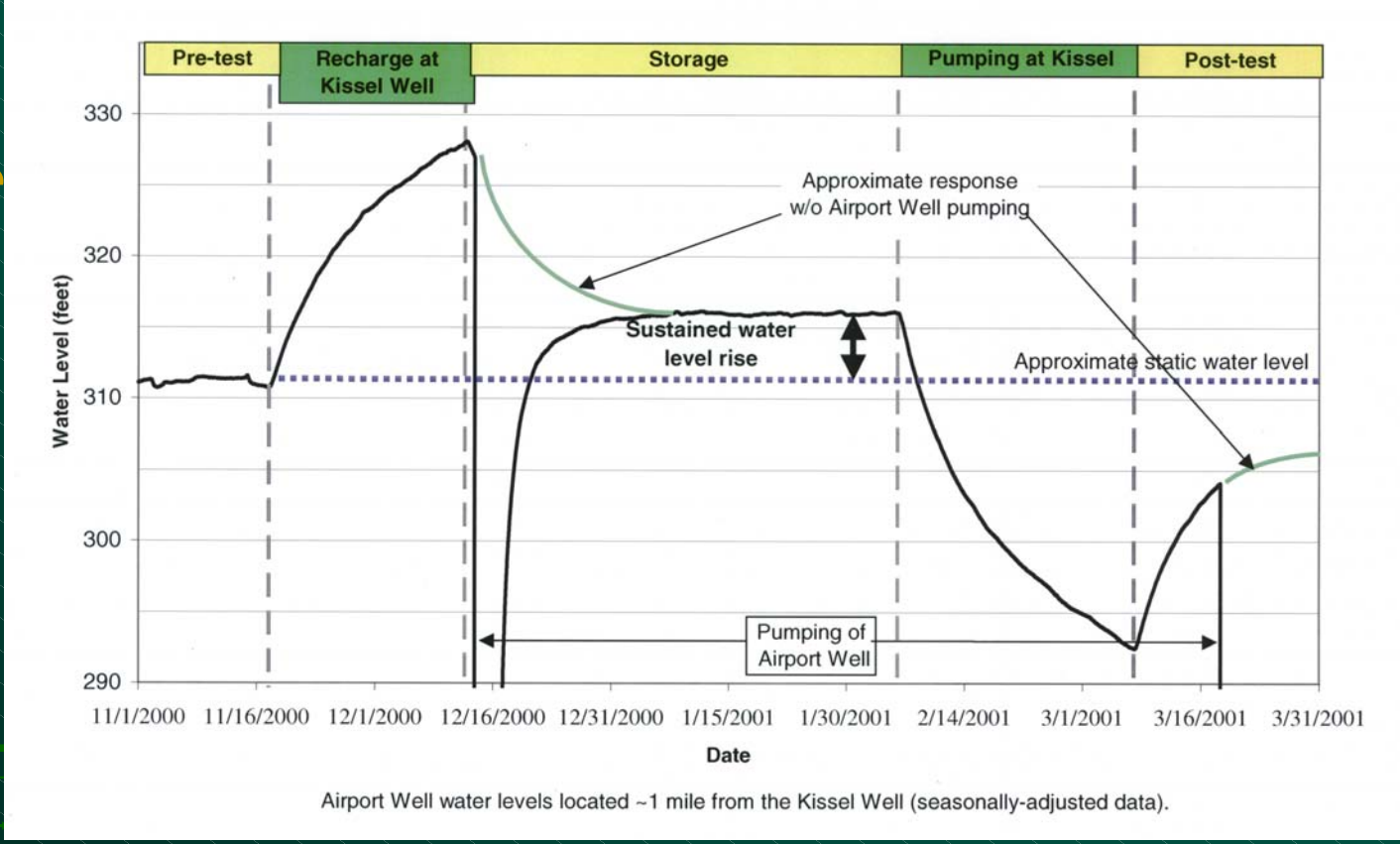
- Used City of Yakima's Kissel Well
- Recharged 43.2 MGal over 25 days (1,200 gpm)
- Storage for 60 days
- Recovered 86.4 MGal over 30 days (2,000 gpm)
- Recharge water source: City of Yakima's Rowe Hill WTP (Naches River)





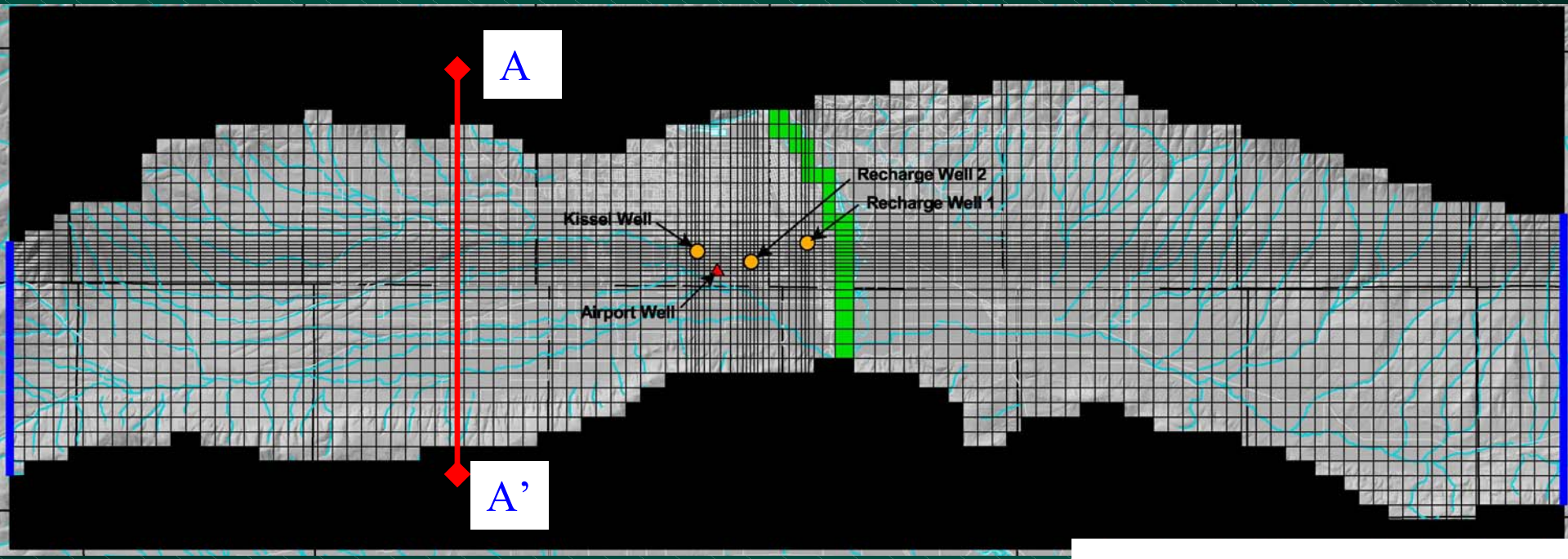
ASR Pilot Test Review

- Sustained water level buildup during storage period
- Recharge water and native groundwater compatible
- Water quality of recovered water excellent
- ASR is feasible
- Aquifer storage capacity ~ 1.7 GigGal



Airport Well water levels located ~1 mile from the Kissel Well (seasonally-adjusted data).

Model Domain

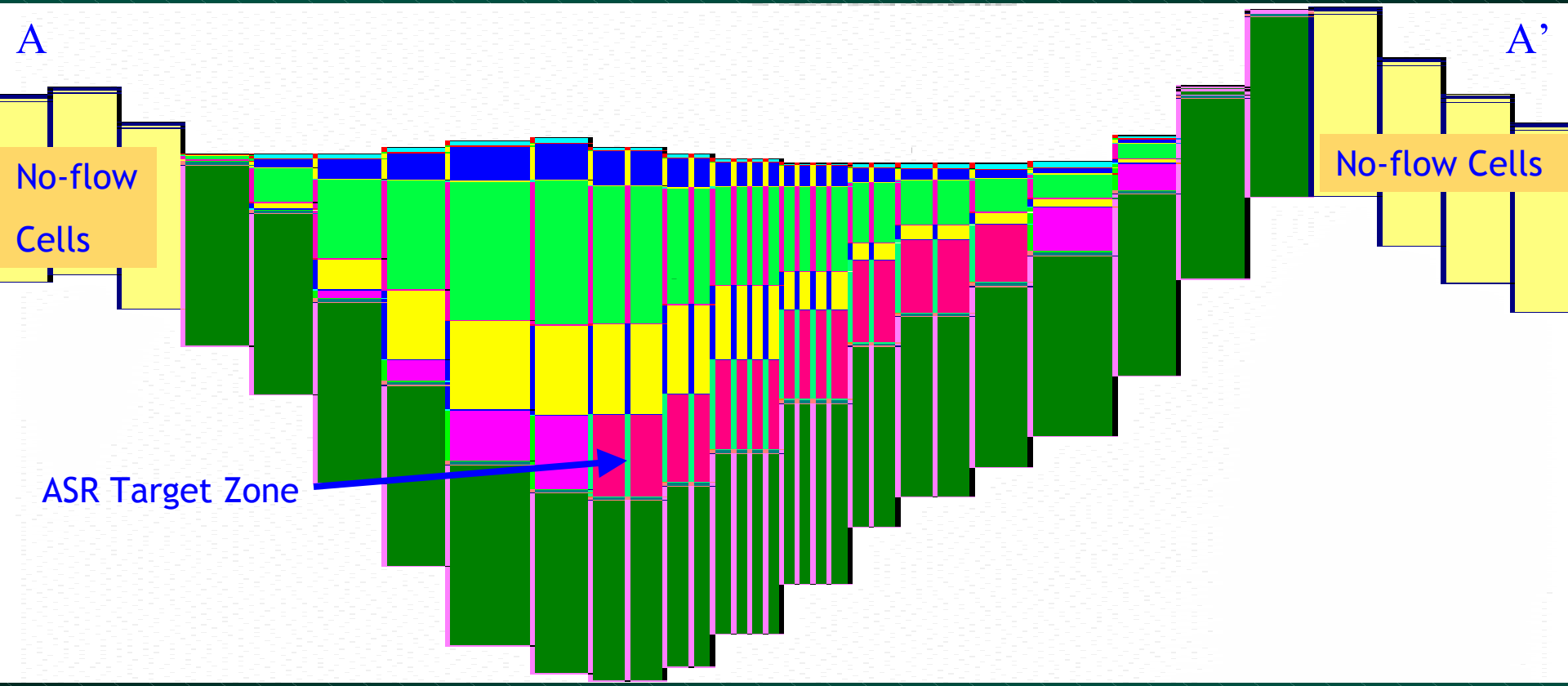


Recharge: USGS Deep Percolation Model Recharge

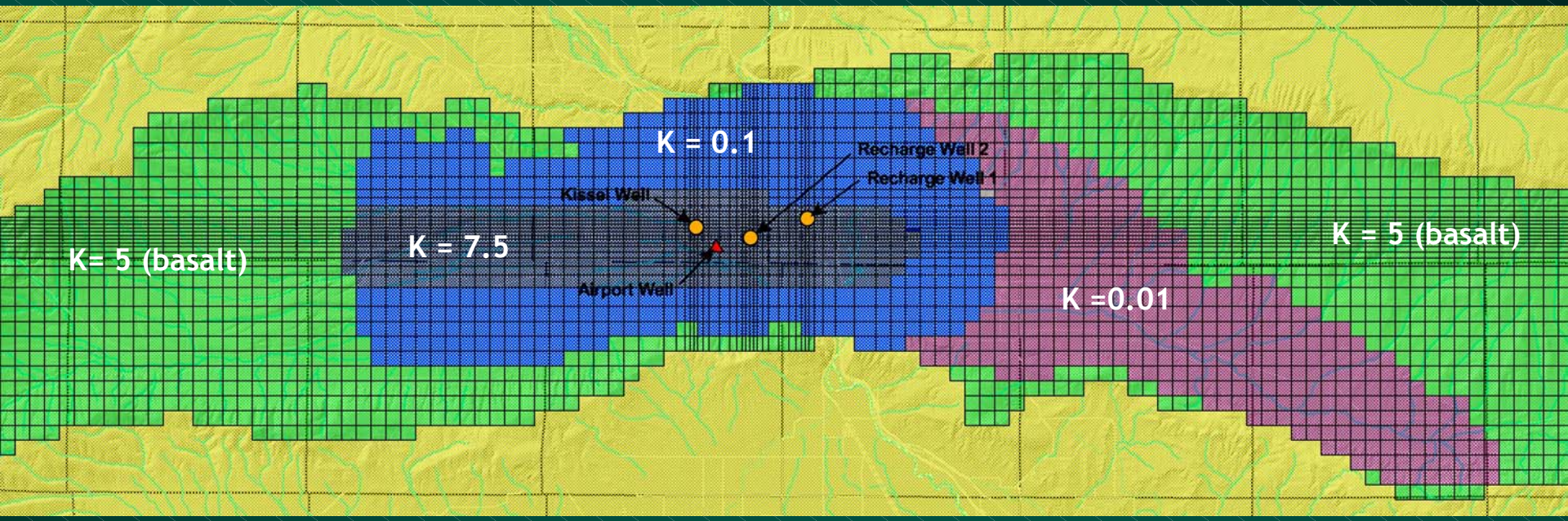
LEGEND

- No Flow Cell
- Constant Head Cells (Layer 1)
- Constant Flux Boundary (Layer 5)

Model Layers

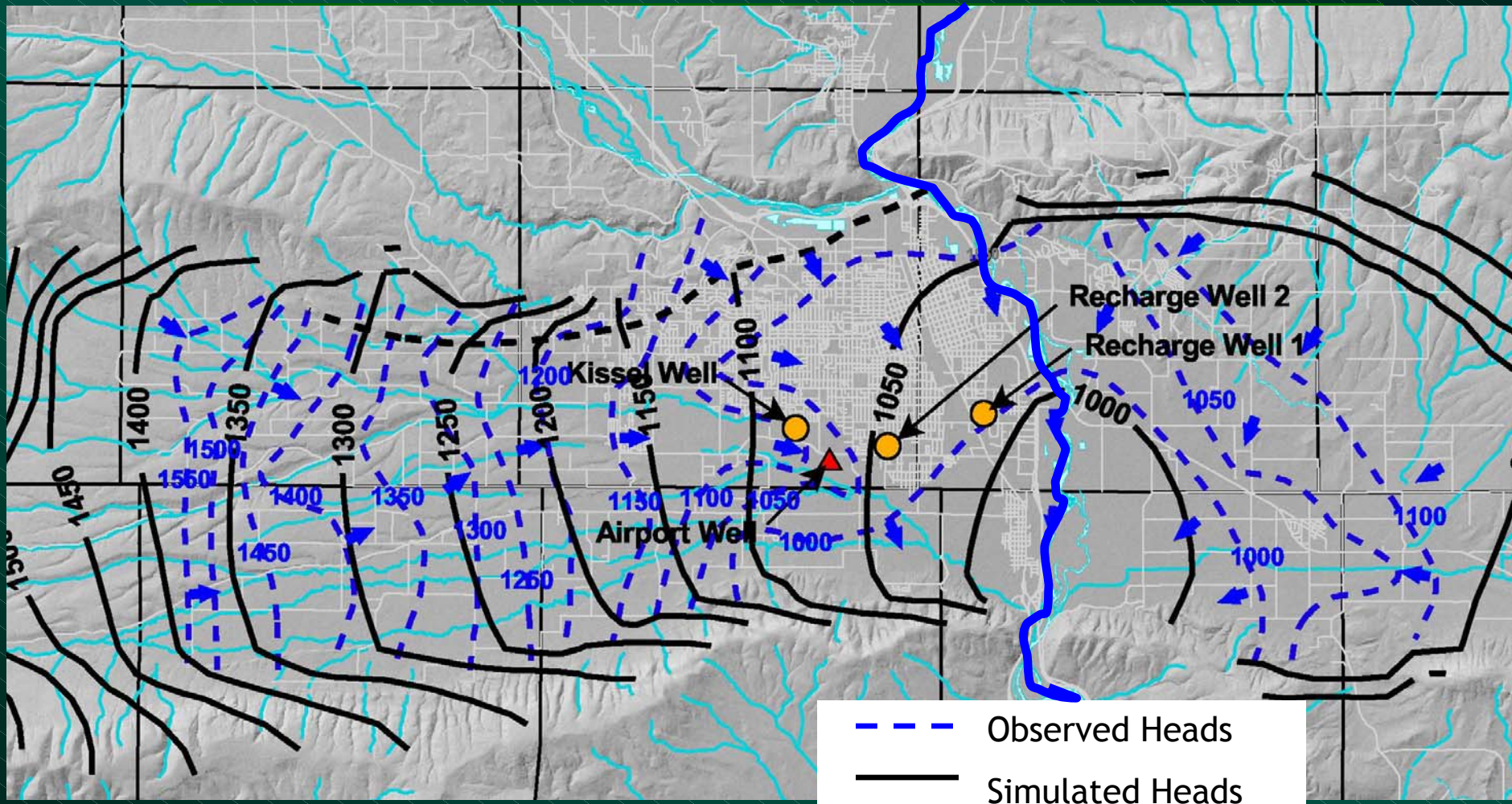


ASR Aquifer Hydraulic Conductivity



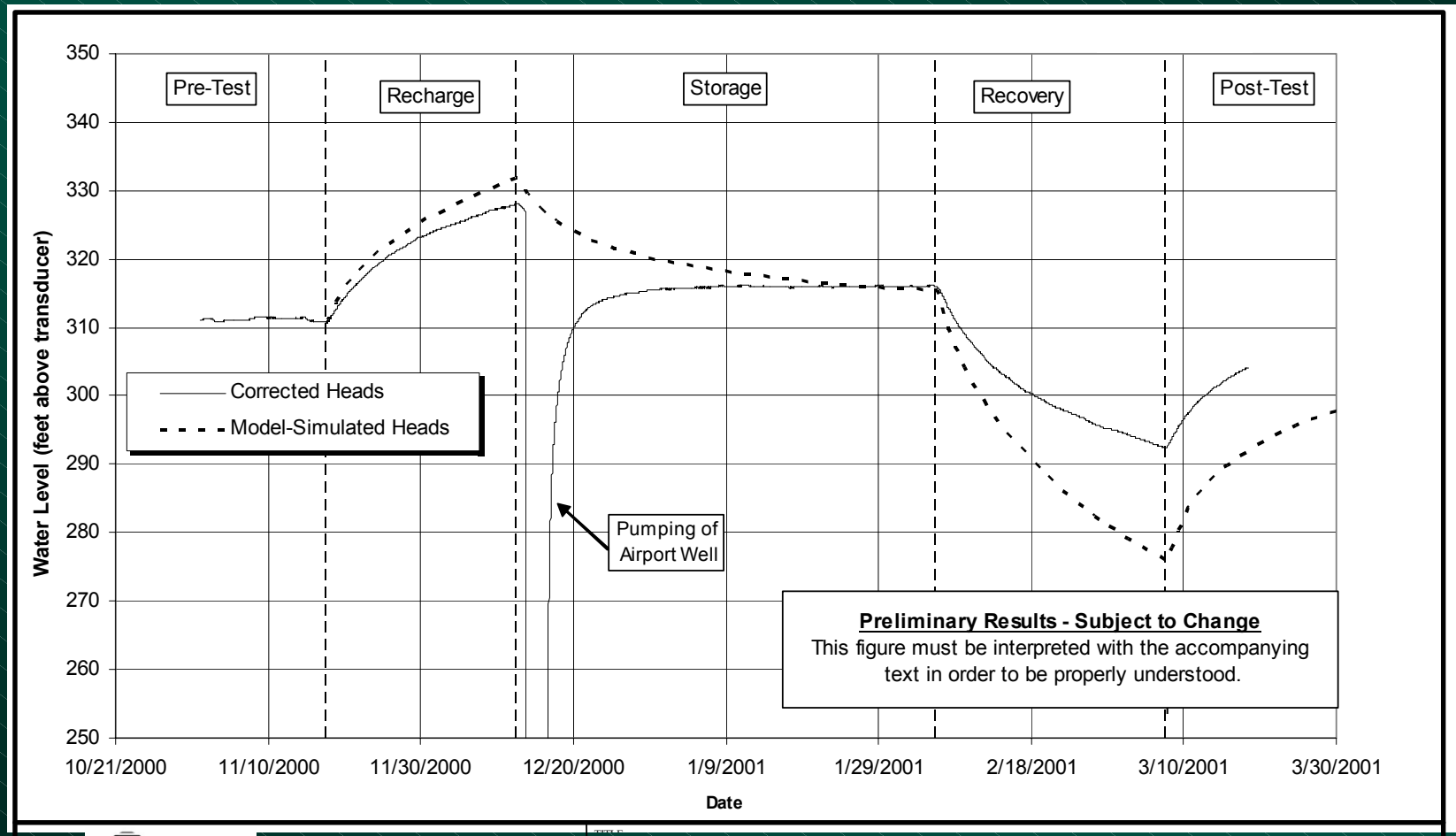
Hydraulic Conductivity in ft/d

Steady-State Calibration



Transient Calibration

Calibration to 2000-2001 Pilot Test Response in Airport Well



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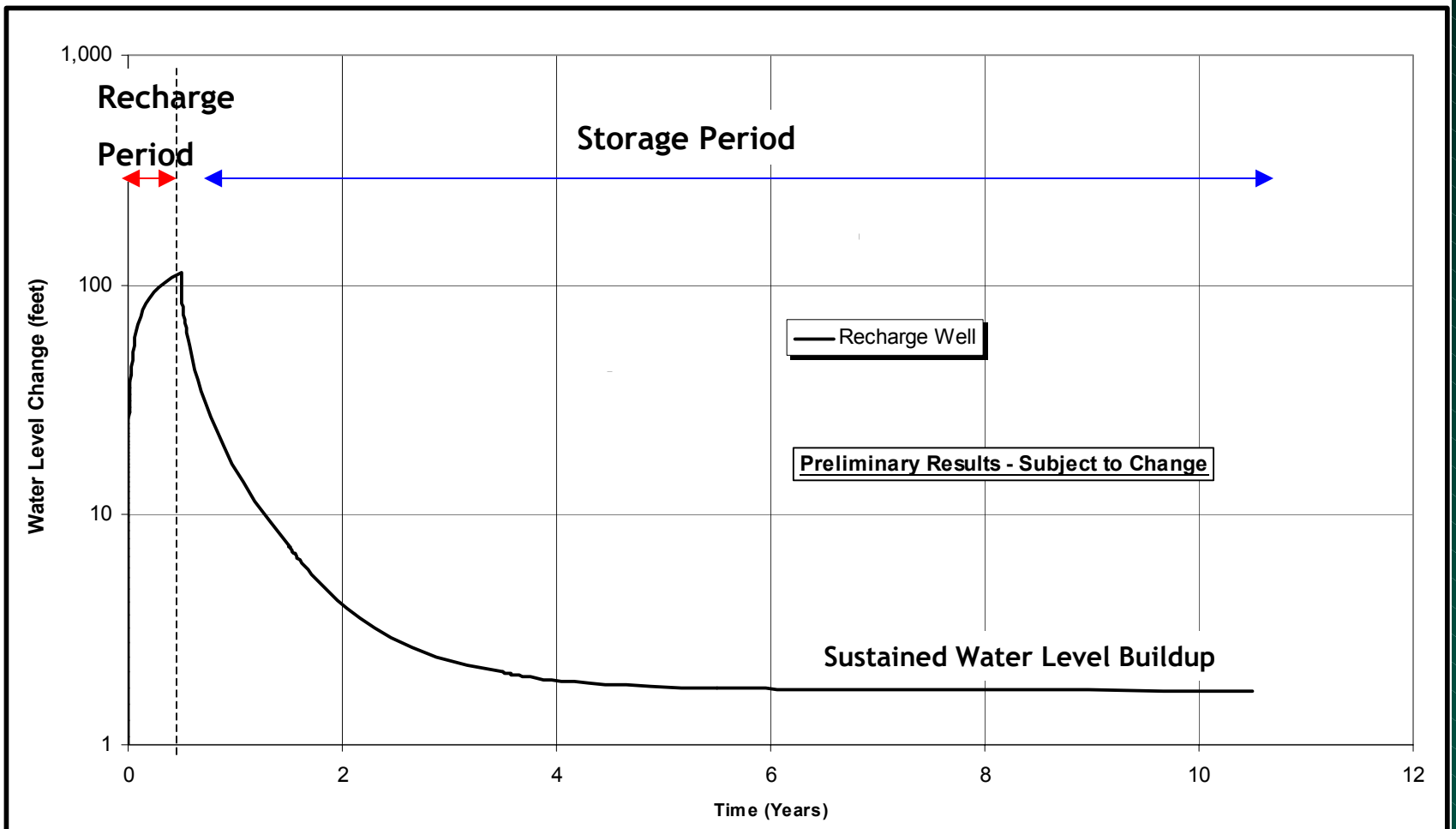
Long-Term ASR Simulation

ASR Parameters:

- *6-month recharge period*
- *3 recharge wells*
- *Total recharge rate 3,000 gpm*
- *Total recharge volume 2,400 AF*
- *Storage period 10 years*

ASR Simulation



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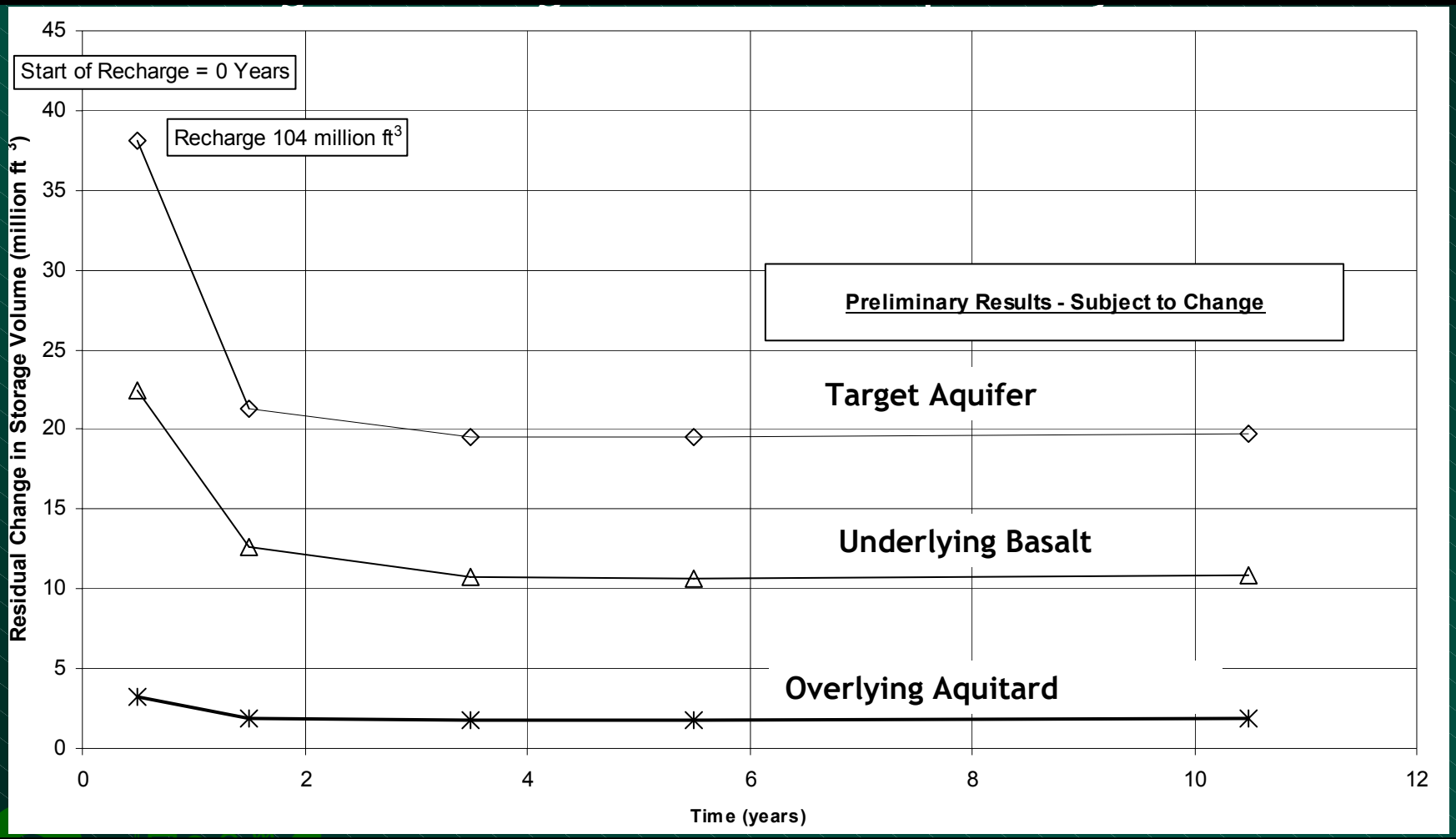
Recharge Well Hydrograph

ASR Simulation

Residual Change in Storage – Confined Aquifer System



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Aquifer Storage and Recovery Evaluation

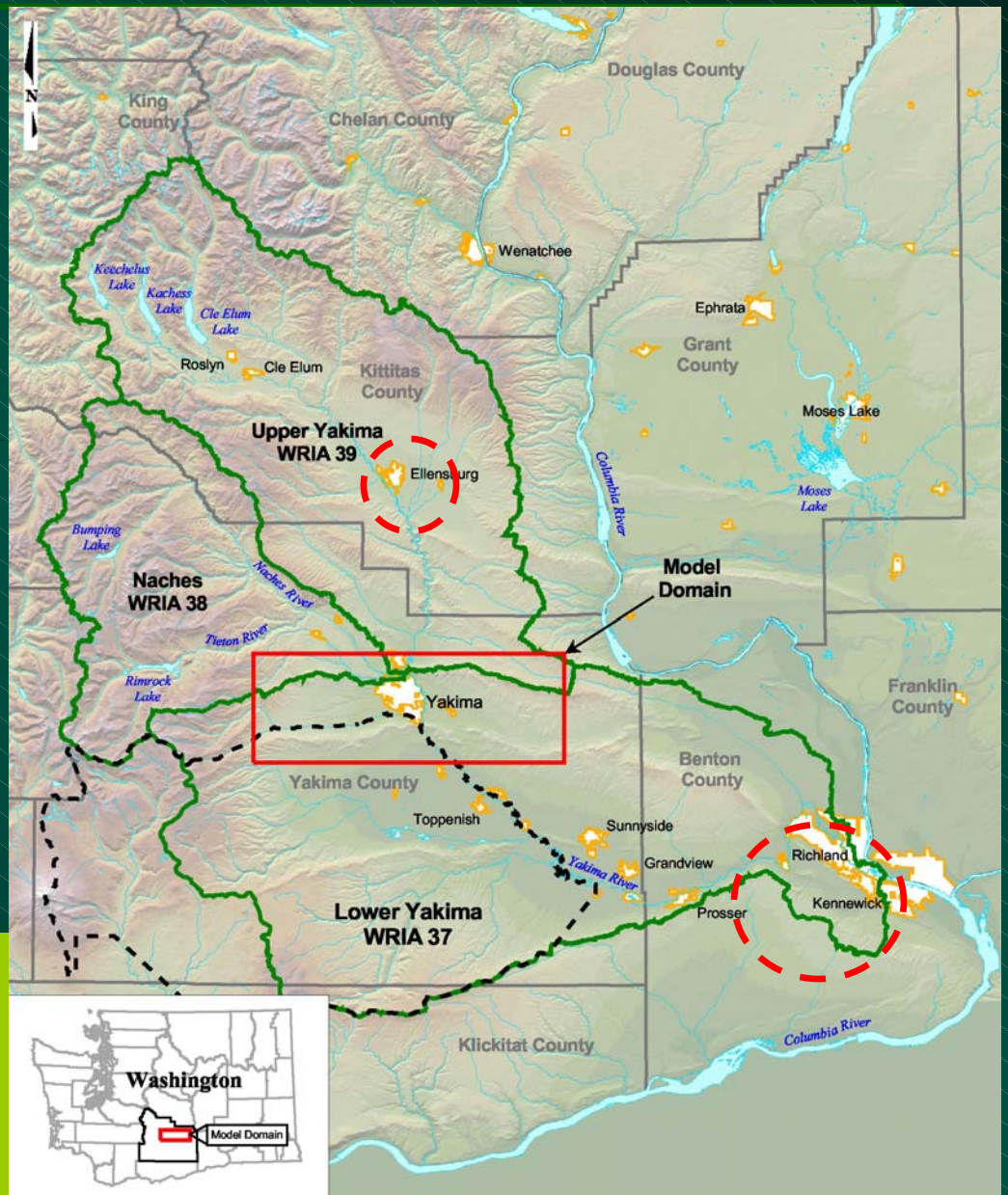
Results:

- *ASR is feasible*
- *Recharge water goes into storage in confined and unconfined portions of aquifer system*
- *Recharge water is contained in the aquifer system for an extended period*
- *Modeling work will support ASR permitting currently in progress*

Regional Applications

Regional ASR Candidate Locations

- Yakima Valley:
  - Deep closed basin
  - Ellensburg Formation-large storage capacity
- Kittitas Valley:
  - Deep closed basin
  - Ellensburg Formation-large storage capacity
- Kennewick/Richland:
  - Columbia River Basalt
- Other areas
  - Lower Yakima Valley?



Questions?
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